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A captive rearing experience of *Clanis undulosa gigantea* ROTHSCHILD, 1894

(Lepidoptera, Sphingidae)

by

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Abstract: An attempt of a captive rearing of *Clanis undulosa gigantea* ROTHSCHILD, 1894 is documented. Optimal conditions (temperature, humidity and food plants) for larvae were determined. Original pupation peculiarities and pupal storage conditions were developed. It has been shown that in captivity this species is multi-brooded on *Robinia pseudoacacia* L. and *Caragana arborescens* LAM. and does not require cold stratification for development.

EITSCHBERGER & IHLE (2008, Farbtaf. 4: 2, 3) could only picture the first instar caterpillar of *Clanis undulosa gigantea* ROTHSCHILD, 1894, because they did not succeed in rearing the species to the end. The foodplant, the L1-caterpillars fed on, also could not be determined. We luckily succeeded in rearing the species from egg to imago. In late May, 2009 we obtained 58 eggs from a wild caught ♀ found on 3.-4.V.2009 by VICTOR SINYAEV in Bhutan, Sambrup - Jongkhar, 26°56'N, 91°33'E, 2273 m. Eggs were placed in Petri dishes lined with tissue paper. On June 6th the first larvae hatched. In fact, only 20 eggs were fertile and produced larvae.
In nature, larvae feed on arboreal Fabaceae (http://tpittaway.tripod.com/china/c_gig.htm). We offered *Robinia pseudoacacia* L. and *Caragana arborescens* LAM. as potential hosts and both plants were accepted well. The first instar larvae were kept in closed plastic cylindrical boxes (volume 1.5 l) with short branches of food plants standing in water. The bottom of the rearing box was lined with a double layer of tissue paper to absorb surplus humidity. In our experiment we maintained constant conditions: temperature +24°C, humidity 86%. Container walls were perforated for ventilation with numerous small holes made using insect pin № 5. The first instar lasted 5 days. The second instar larvae (col. pl. 1: 4) were held in the same boxes as before. From the third instar until pupation, larvae were reared in large plastic containers of the size 25 cm × 30 cm × 40 cm. We simply placed cut branches of *Robinia* into these containers and changed them every third day or earlier, if required.
Pupation takes place in the soil. Contrary to other hawk-moths, the *Clanis* species hibernate in the larval stage. Usually larvae stay in soil chambers for 3-4 weeks before pupation, but sometimes this stage lasts up to several months. For the first brood pupation we used cylindrical 3 l plastic boxes with a layer of pine sawdust. Of 16 larvae approaching pupation, 6 developed as normal pupae, 2 failed during the pupation process over 21-30 days, 5 pupae decayed and 3 remained in long-term diapause. As 7 larvae died during pupation we concluded that wet sawdust is not suitable for rearing. The pupal stage lasted 18-24 days.
The first moth, a ♂, hatched on 4.IX.2009. The first ♀ (col. pl. 1: 13) emerged two days later on 6.IX.2009. Adults of this species have a well-developed 5 cm long proboscis (col. pl. 1: 14) and we tried to feed them with a honey-water solution (1:5). However, the moths imbibed very poorly, suggesting they do not feed in nature. At night, the adults were kept outdoors in a large cylindrical net cage (height 100 cm, diameter 50 cm) at a temperature of 8-15°C. During the day we kept them indoors in damp conditions at a temperature 24°C. Mating took place on 7.IX.2009 in the morning around 5:30 am (col. pl. 1: 15). Moths remained in copula until the next evening and separated around 7:00 pm. The ♀ started to lay eggs during the night following that of mating. The reared moths measured 115-140 mm in wingspan and so were smaller than wild specimens.
The second generation was reared under the same conditions. On 26.X.2009 the first larvae began to pupate. Colour changes very slightly to yellowish, therefore larvae approaching pupation can be determined only by their active crawling. The wandering phase takes 1-2 days, but even after this period larvae extracted from pupation chambers are able to crawl, because it is not a typical prepupal stage. This time we used for pupation plastic boxes with a damp layer composed of small pieces of tissue paper. These boxes were put in a dark cool place at a temperature of 19°C. On 21.XI.2009 the first larva pupated. As in earlier experiences, pupation took place 3-4 weeks after the larvae completed feeding. At this stage, we obtained 15 pupae (11 ♂♂, 4 ♀♀) from 33 mature larvae. Pupae were stored the same way as the remaining diapausing larvae. After three weeks the first adults appeared. The remaining 18 larvae were placed into a fridge for overwintering (col. pl. 1: 8). Hibernation began on 10.XII.2009 at a temperature 5°C and continued well until 27.II. 2010 when two larvae changed colour to brown and died. We decided to interrupt the overwintering and removed the pupae from the fridge, storing them at a temperature of 25°C in a fresh layer of wet tissue paper. During the next 10 days another 11 larvae turned colour to brown and died. Only 5 larvae remained alive and pupated successfully between 1.-9.IV. 2010, producing adults after 21-24 days.
Our experience has shown that cold temperatures are not suitable for the development of that species. However, we were obliged to do so in order to ensure the survival of this wonderful species during winter, when larval hostplants are not available.

Description of the preimaginal instars (col. pl. 1)

Ovum: Pale-yellow, weakly ellipsoid, shiny and smooth. Size 1.9 × 1.9 × 2.3 mm.
Larva: The freshly hatched larva is yellowish with a grey horn. Head is round and larger in diameter than body. Horn is well developed, 2 mm in length, straight and bifid on the tip. After cuticle induration horn becomes reddish-brown with a yellowish ring close to the black tip. After commencement of feeding the body becomes yellowish-green; body pattern is absent.
In the second instar, the green head becomes triangular with two conical reddish-brown processes on the apex. The head tubercles are yellowish. Body ground colour is bright green and is covered with rows of small lighter tubercles. The narrow subdorsal and subspiracular stripes of larger tubercles appear on the segments II-IV. Then the latter stripe merges with the lower end of the oblique lateral stripe on segment V. There are narrow oblique lateral stripes from larger tubercles on segments V-XI. Horn remains unchanged in coloration, but becomes longer.
In the following two instars, larval appearance shows only minor changes - the head processes and horn become shorter and tubercles more glabrous.

In the final instar, head is very large, green, roundly triangular, apical processes are reduced. Fully-fed mature larva reaches 80-90 mm in length and 14-15 mm in width. Body is green, tubercles are yellowish-white. Stripe pattern remains unchanged, but is more prominent. Spiracles are oval (col. pl. 1: 3), black with double ellipsoid pattern. Head surface is shiny, with large, oval tubercles from the apex of each lobe to base of antenna. Frontal surface is covered with large, irregularly shaped, flattened tubercles which touch each other; rest of head bears large, rounded, scattered tubercles. Legs are reddish-brown, prolegs and claspers are green. Horn is green, reduced and has the appearance of a 2 mm long tubercle.

Pupa: Reddish-brown, shiny and smooth. Size: 60 mm in length and 18 mm in width. Spiracles and cremaster are black.

Conclusions: *Clanis undulosa gigantea* Rothschild, 1894 is rare enough, as wild ♀♀ are rarely attracted to the light. In captivity this species is multi-brooded and does not require obligate cold stratification for development. In Europe, rearing is not a problem other than attempting to maintain the viability of hibernating larvae during winter, when food plants are not available. Larvae require an optimal humidity balance when overwintering for long periods in cold conditions: if humidity is too low they slowly desiccate, if too high, they decay. Another problem is the fact that larvae do not pupate immediately after burrowing into the soil and this phase varies in time for each individual. As a result, adult emergence times are hard to synchronize. These facts makes the species rarely successful in captive breeding programmes.

The specific identity of the reared specimens was confirmed using genitalic characters (fig. 1) based on the revision of Eitschberger (2004).

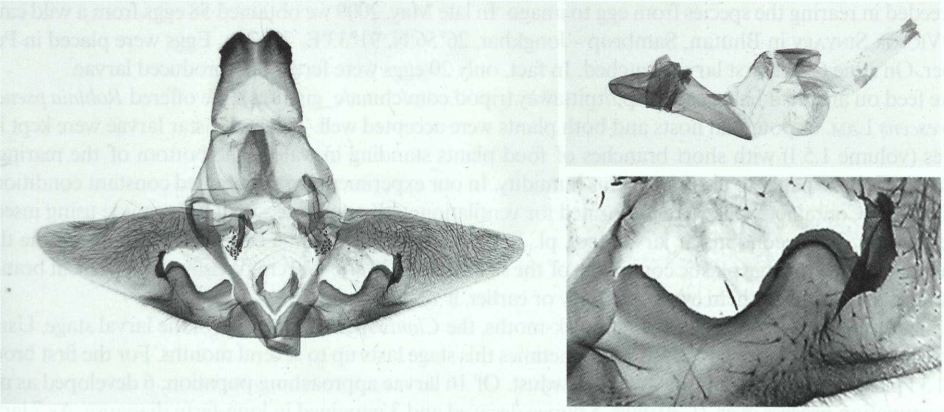

Fig. 1: ♂ genitalia of *Clanis undulosa gigantea* Rothschild, 1894, Bhutan, Sambrup - Jongkhar, 26°56'N, 91°33'E, 2273 m, second brood.

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References

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Figs 1-15: *Clanis undulosa gigantea* Rothschild, 1894, life-cycle. (1) eggs, (2) head of a mature larva, (3) larval spiracles, (4) 2nd instar larva, (5) 3rd instar larva, (6) 4th instar larva, (7) 5th, and final instar larva, (8) pronymphs approaching hibernation, (9) plastic containers with overwintering larvae, (10) pupa (ventral view), (11) pupa (lateral view), (12) cremaster of pupa, enlarged, (13) adult ♀, (14) head of the ♀ showing proboscis,(15) mating.